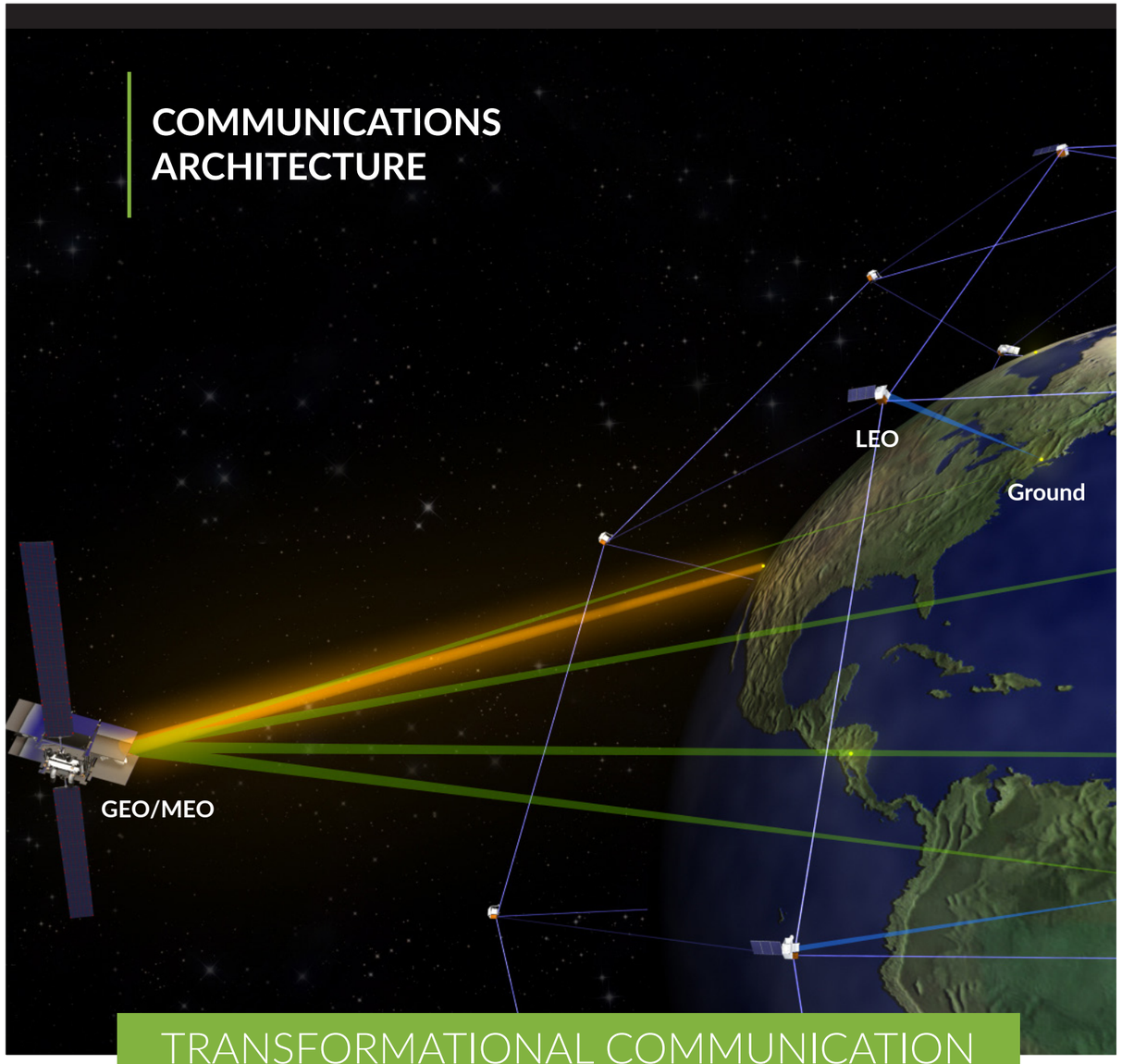
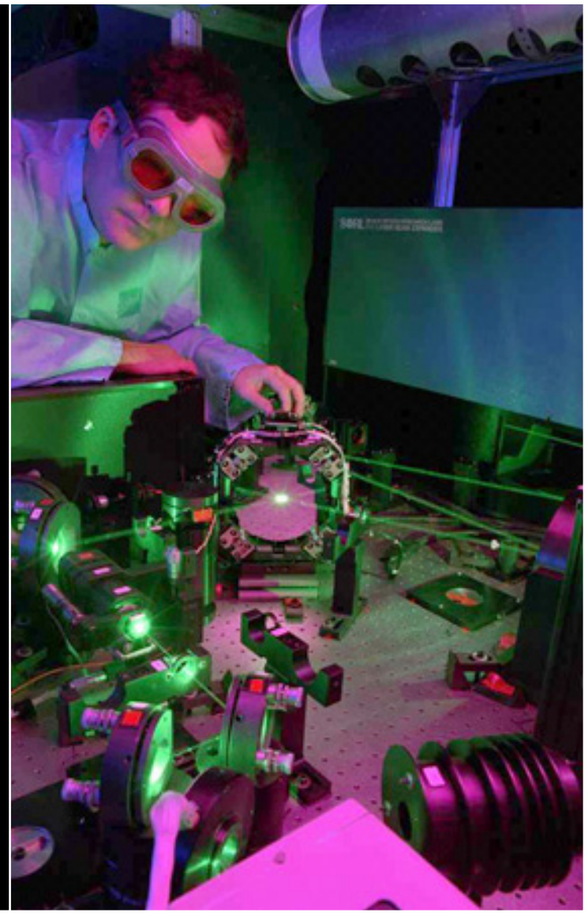
OPTICAL COMMUNICATIONS



TRANSFORMATIONAL COMMUNICATION

More data, anytime, anywhere.

Wherever your data must travel - between satellites and to and from space - our technology goes too, enabling satellite operators to meet the world's data demand.



GO BEYOND WITH BALL.®

When you need data at the speed of light, our line of affordable, state-of-the-art optical communication terminals deliver, providing high-bandwidth, ultra-high data-rate connections across the entire communications architecture - from ground to LEO to GEO and back.

Ball Aerospace
303-939-6100 • Fax: 303-939-6104 • info@ball.com • www.ball.com/aerospace

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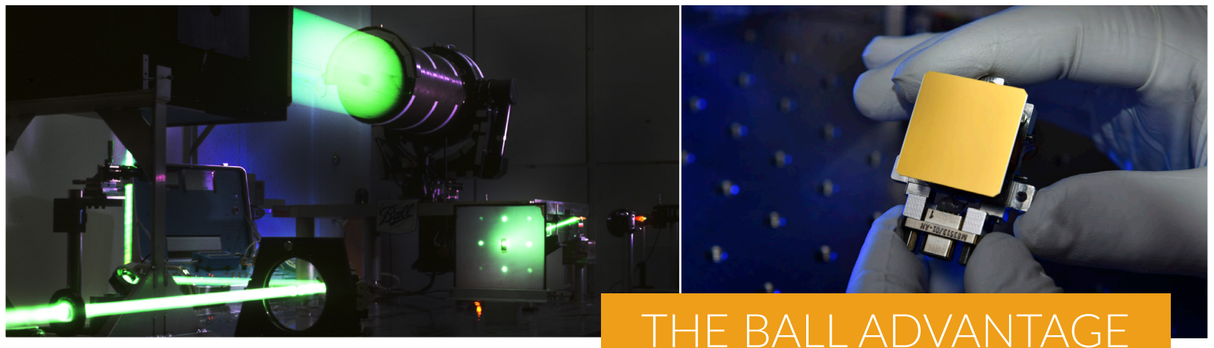
GO WITH CONNECTIVITY

Unlocking the power of light to bring ultra-high data-rates to space.

As the demand for data increases, communication satellites must be able to transmit and deliver more information, faster and more securely than ever before. As a result, the need for high bandwidth communication links is growing rapidly.

Free-space optical communication systems provide an innovative alternative to traditional radio frequency solutions, bringing the Internet speeds of terrestrial fiber optics to space.

Using laser technology, optical communication systems offer a much narrower and more focused beam than traditional RF links, resulting in higher data rates, more capacity, greater security, and smaller, lighter and more affordable terminals.

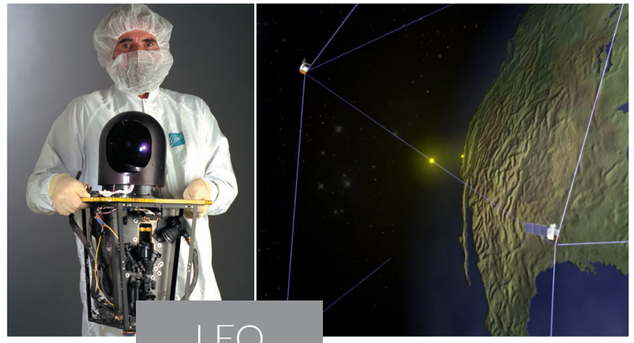


THE BALL ADVANTAGE

Ball is an industry leader in advanced laser technologies.

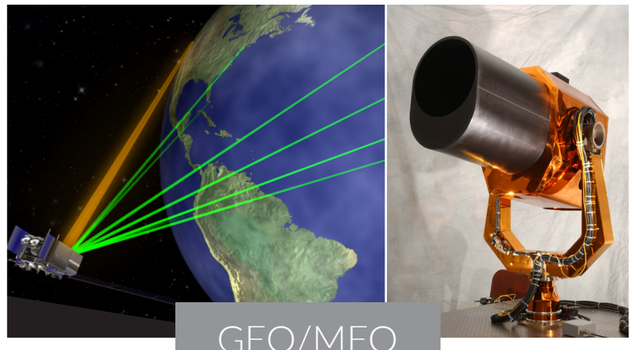
Ball is developing a line of high performance optical communication terminals to provide reliable, high-capacity, high-speed connections across the entire communications architecture.

We are combining our 30-year heritage in developing proven laser technologies with a deep understanding of satellite and communication systems to develop advanced laser communication solutions for a wide range of markets and applications. Manufactured entirely from North American-sourced parts, our terminals are an assured, secure solution for domestic missions.



LEO

Our LEO terminal shipsets are designed to allow each satellite in a constellation to reliably track and communicate with its nearest neighbors. Modular, cost effective components are used to efficiently meet the volume and delivery schedules needed for LEO communications constellations.



GEO/MEO

Developed for high volume MEO and GEO feeder links, our space and ground terminals provide the reliability and performance needed by today's high-throughput communications satellites. Through ground site diversity and exceptional optical stability, we provide dependable communications links for data distribution and backhaul.

SYSTEM PERFORMANCE

Ball's line of high-bandwidth optical communication terminals provide numerous benefits:

- **High data rates:** 5 Mbps to > 100 Gbps for current and future network architectures
- **Precision optics:** < 3 dB transmit and receive losses and < 0.1 waves RMS to accommodate high efficiency terminals – single mode fiber coupled where appropriate
- **Low jitter:** < 1 microradian jitter and bias error with typical spacecraft platform disturbances
- **Thermal Stability:** Thermal control, ± 10° C, of telescope and optical bench assembly to accommodate typical spacecraft environments with high TRL optical designs
- **Field of Regard:** Body pointed up to hemispherical coverage to support satellite orbits
- **Low latency:** < 100 microseconds at 10 Gbps, not including propagation delay
- **Site diversity:** Multiple ground sites to accommodate clouds and atmospherics with make-before-break capability
- **Apertures:** ≤ 5 to ≥ 40 cm available to support data needs
- **Mass and Power:** Mission specific